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A MINI-CATCHER FOR TOXIC MATERIALS IN PLATE IMPACT EXPERIMENTS.(U)
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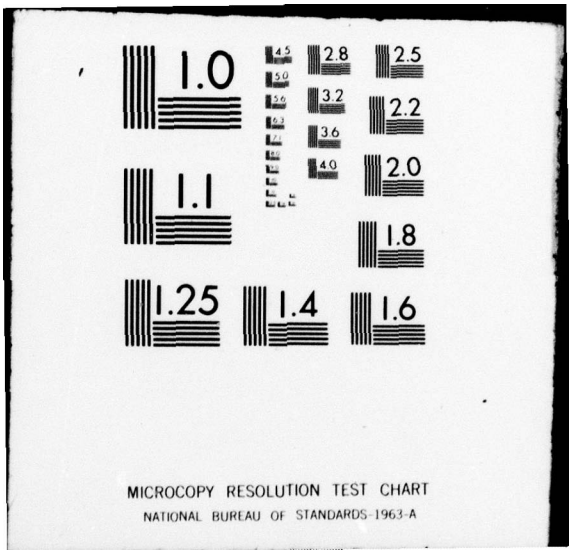
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A device to capture fragments of a toxic material resulting from plate impact experiments is described.

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INTRODUCTION

A common problem encountered when performing plate impact or ballistic experiments in an enclosed facility with toxic or/and hazardous materials, like beryllium or depleted uranium, is the containment of toxic particulates of these materials to minimize exposure to personnel and simplify decontamination of the facility. A solution to this problem for the 10.2-cm- (4 inches) diameter gas gun facility of the Ballistic Missile Defense Materials Program Office at AMMRC is the subject of this report. The concept may be readily used in other laboratories with similar facilities by applying appropriate scaling. The present device, called "a mini-catcher," has been successfully used to 0.3 km/s (984 ft/s) in the experiments performed at the AMMRC facility.

DESIGN OF THE MINI-CATCHER

The mini-catcher is fabricated from 6061-T6 aluminum tubing which has an outer diameter of 12.7 cm (5 inches), an inner diameter of 8.9 cm (3.5 inches), and a length of 41.3 cm (16.25 inches). The inner wall of the tubing is machined at an angle of 1°08' to a length of 22.9 cm (9 inches), see Figure 1, to produce a smoothly decreasing inner diameter of the tubing. The inner diameter decreases from 10.8 cm (4.26 inches) to 9.92 cm (3.906 inches) at 22.9 cm (9 inches). From that point it is machined at an angle of 5° for 5.8 cm (2.3 inches). The inner diameter decreases to 8.9 cm (3.5 inches) and remains constant to the end of the tubing. The length of the first taper machining was chosen so that the rear of the projectile would not damage the muzzle of the gun before the deformation of

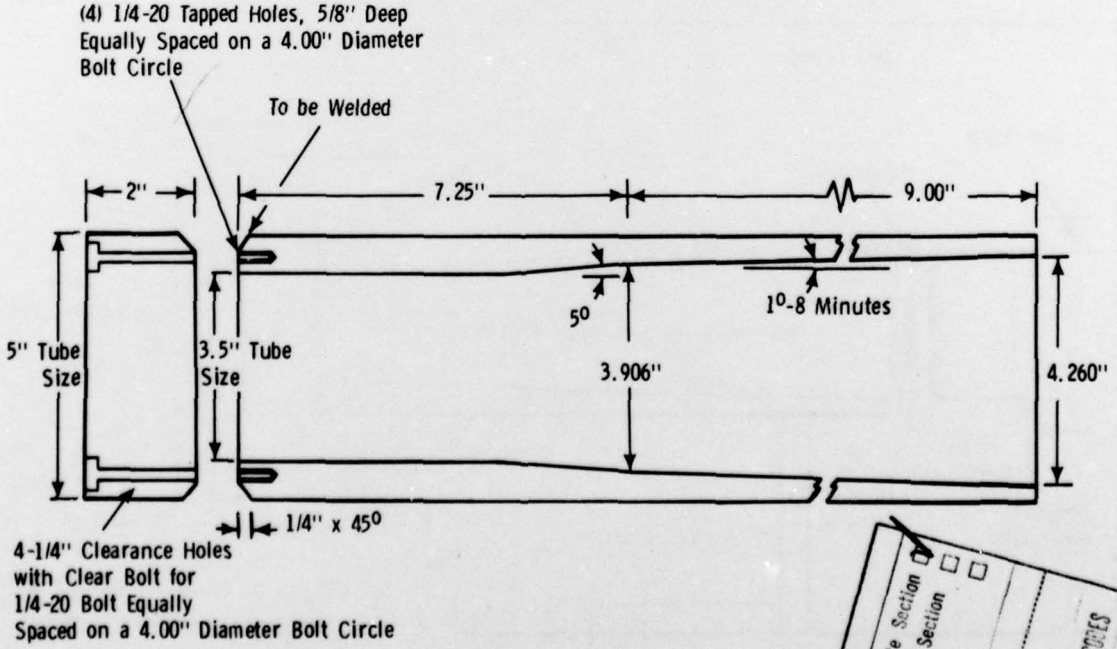

Figure 1. Machine drawing of the mini-catcher.

the mini-catcher begins. The inner diameter of the tubing at this point is 9.92 cm (3.906 inches). Subsequent motion of the projectile deforms both the projectile and the aluminum tubing as the projectile forces its way into the ever decreasing inner diameter of the tubing and continues to lose its kinetic energy. The debris from the target and projectile are caught between the end cap of the mini-catcher and a maximum of 12.57 cm (4.95 inches) space therefrom. The end cap, made of 6061-T6 aluminum solid stock, is fastened to the tubing by a set of four bolts and is also welded at the common boundary of the two.

In a plate impact experiment the toxic specimens are mounted either on the target or on the projectile or on both the target and the projectile. In order to capture the fragments resulting from the impact of the projectile on the target, the mini-catcher is mounted just behind the target and concentrically with the bore of the gun (Figure 2). After the impact the projectile (normally weighing between 1 to 1.5 kg) and target force themselves smoothly into the decreasing bore of the mini-catcher. The deformation of the projectile and the catcher dissipate the kinetic energy as the whole assembly moves with decreasing velocity into a large rag-filled tank. A photograph of a projectile sealed into a mini-catcher is shown in Figure 3.

These mini-catchers have been successfully used in 16 plate impact experiments on beryllium with projectile velocities varying between 0.12 km/s (394 ft/s) and 0.3 km/s (984 ft/s). The level of surface concentration of beryllium in the target chamber, or catcher tank, never exceeded 2.0 μg/100 cm^2. The average concentration was found to be less than 1.2 μg/100 cm^2. AMMRC maximum allowable surface contamination for a clean area is 4.0 μg/100 cm^2, less than the 5 μg/100 cm^2 recommended in Reference 1.

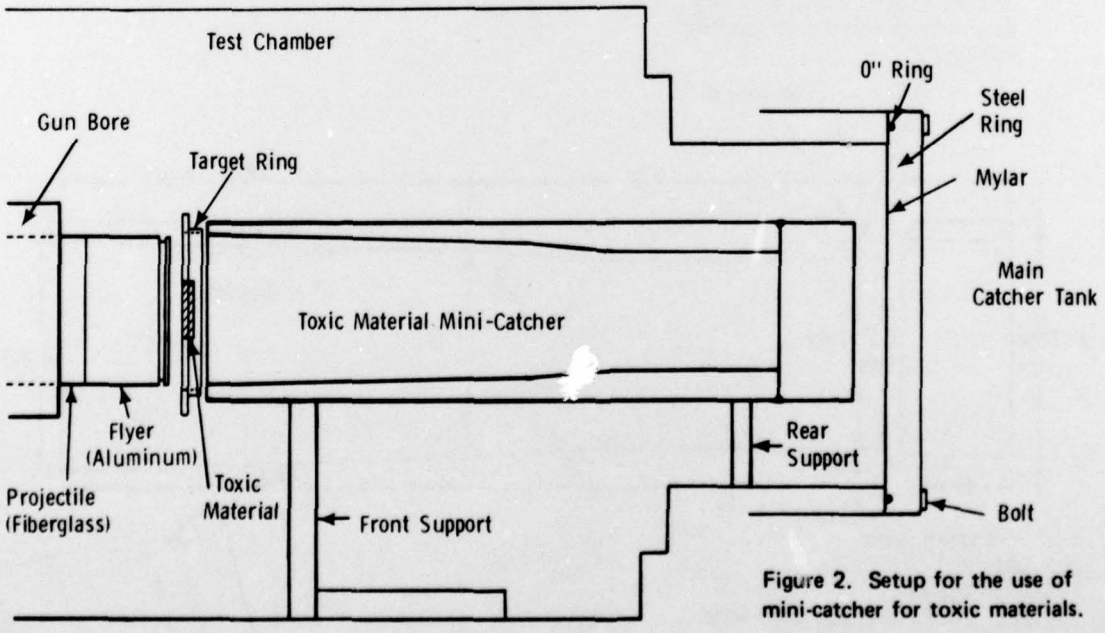

Figure 2. Setup for the use of mini-catcher for toxic materials.

1. STOKINGER, H. E. *The Documentation of the Threshold Limit Values.* American Conference of Governmental Industrial Hygienists, Ohio, 1971, p. 24.

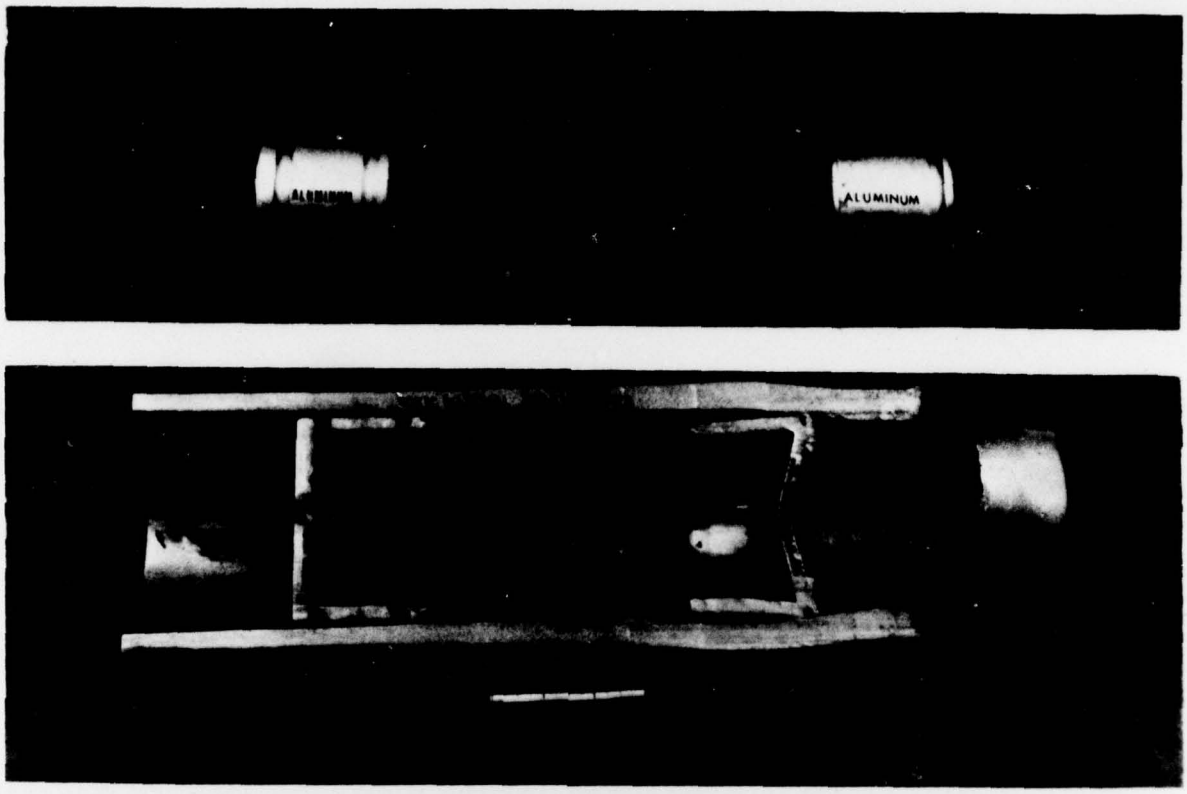

Figure 3. An undeformed projectile and cutout section of used mini-catcher showing that the projectile seals the end zone of the mini-catcher.

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The maximum velocities to which this type of mini-catcher may be used can be conceivably increased to 0.75 km/s (2460 ft/s) by inserting a steel tube with 0.15-cm (0.06 inch) wall thickness and appropriate outer diameter in the mini-catcher as reported in Reference 2.

COST

The cost of each mini-catcher fabricated from 6061-T6 aluminum tubing is less than half the cost of a similar mini-catcher machined from solid aluminum stock by experimentalists.[2] Thus the present mini-catcher offers an obvious cost benefit with no loss in safety.

2. HORNING, R. R., and HICKMAN, G. L. *Toxic Material Catcher for Gas Guns.* Review of Scientific Instruments, v. 46, no. 1, 1975, p. 99-100.

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